

**Biological Overview of  
HAWAII'S NATURAL AREA RESERVES SYSTEM  
Appendices**

**Prepared for:**

**HAWAII STATE DEPARTMENT OF  
LAND AND NATURAL RESOURCES**

**Prepared by:**

**Hawaii Heritage Program  
The Nature Conservancy of Hawaii**

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APPENDICES

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## Appendix 1

### **Hawaiian Natural Community Classification**

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## Appendix 1: Hawaiian Natural Community Classification

The Hawaiian Natural Community Classification is hierarchical, with native community types grouped in four large systems (marine, aquatic, subterranean and terrestrial). The marine system has not yet been incorporated into the classification. Within the three non-marine systems, communities are named according to characteristics such as elevation, moisture conditions and overall structure. There are five broad elevation zones defined as follows:

COASTAL	Sea level to extent of sea spray (ca 100 ft)
LOWLAND	Sea level to 3000 ft elevation
MONTANE	3000 to 6000 ft elevation
SUBALPINE	6000 to 9000 ft elevation
ALPINE	above 9000 ft elevation

Only the two largest islands, Maui and Hawaii, contain examples of all five elevation zones. Kauai, Oahu, Lanai and Molokai lie largely in the coastal and lowland zones, but extend into the montane zone. The remaining islands, Niihau, Kahoolawe and the Northwestern chain, lie only in the coastal and lowland zones.

For the aquatic and subterranean systems, characteristics of structure determine the community names within each elevation zone. For example, there are coastal anchialine pools and montane freshwater lakes; coastal limestone caves and alpine lava tubes. Currently, the classification system for aquatic and subterranean systems ends with physical characteristics, but eventually, the biological aspects will be incorporated, so that communities such as "Montane Blind Cricket Lava Tube" may be described.

The terrestrial system is subdivided further than the aquatic and subterranean systems. Within each elevation zone, rainfall and groundwater conditions determine three moisture classes that are applied to the terrestrial portion of the classification, as follows:

DRY	Receiving less than 50 inches of annual rain, or with prevailing dry soil conditions.
MESIC	Receiving between 50 and 100 inches of annual rain, or with prevailing moist soil conditions.
WET	Receiving greater than 100 inches of annual rain, or with prevailing wet soil conditions.

While annual rainfall is generally a good indicator of moisture class, other habitat factors (such as soil characteristics, slope, exposure to wind or sun, access to

groundwater or surface waters, fog drip or cloud moisture, seasonality of rainfall, etc.) can make prevailing soil moisture conditions either drier or wetter than rainfall data alone might indicate. For example, windward sea cliffs may receive annual rainfall well above 100 inches, but steep slopes, strong wind and high exposure can lead to prevailing dry and mesic conditions.

The combination of five elevation zones and three moisture classes allows for fifteen possible elevation-moisture conditions, most of which occur in the Hawaiian Islands. Another level of the terrestrial classification is based on physiognomy (general vegetation structure) and is divided into six groups:

DESERT	Vegetation lacking or extremely sparse
HERBLAND	Vegetation extremely low, not woody
GRASSLAND	Dominated by grasses or sedges
SHRUBLAND	Dominated by shrub species
FOREST	Dominated by tree species
MIXED	Dominated by combinations of the above (most commonly, shrub and grass combinations)

Together, the elevation-moisture-physiognomy hierarchy creates broad categories of community types. For example, most of Oahu's remaining native communities are lowland wet forests or lowland mesic forests. More specific community types are named for the dominant canopy plants. For example, the lower ridges of the Koolau Mountains are mesic, and often dominated by koa (*Acacia koa*) and 'ohi'a (*Metrosideros polymorpha*), with a variety of vegetation in the understory. In the classification, this community is called a "Koa/'Ohi'a Lowland Mesic Forest". In general, a vegetated area must exceed 60% cover in native species to be considered an example of a native natural community. Exceptions may be made if all of the known examples of a rare community are highly degraded and have less than 60% native cover. The diversity of Hawaiian natural communities is summarized in the following table:

THE DIVERSITY OF HAWAII'S NATIVE NATURAL COMMUNITIES

SYSTEM	NUMBER OF COMMUNITIES <sup>1</sup>						Total
	Coastal	Lowland	Montane	Subalpine	Alpine	Multi-zonal	
MARINE	not yet included in classification						
AQUATIC*	7 (5)	4 (3)	1	-	1 (1)	3 (1)	16 (10)
SUBTERRANEAN*	2 (2)	4 (4)	4 (4)	1 (1)	1 (1)	-	12 (12)
TERRESTRIAL							142 (119)
Dry	29 (23)	23 (19)	6 (6)	8 (8)	4 (4)	-	70 (60)
Mesic	5 (3)	23 (18)	7 (7)	2 (2)	-	-	37 (30)
Wet	1	17 (11)	20 (15)	1 (1)	-	-	39 (27)
Variable	-	-	-	-	-	6 (2)	6 (2)
TOTALS:	44 (33)	71 (55)	38 (32)	12 (12)	6 (6)	9 (3)	180 (141)

<sup>1</sup> number of rare communities shown in parentheses:  
For example, 7 (2) indicates 7 total communities, 2 of which are rare.  
Detailed list in Appendix 3; Definition of rarity in Appendix 2.

\* Based on provisional classification, not complete.

## Appendix 2

### Definition of Rarity

## Appendix 2: Definition of Rarity

A plant, animal or natural community is considered rare and imperilled if it is known from 20 or fewer localities in the world, or (in the case of a species) if total population size is less than 3,000 individuals. More widespread species or natural communities that are threatened with destruction throughout their range are also considered rare.

In the Hawaii Heritage Program, ranks are assigned to species and communities on the basis of their world-wide rarity and endangerment. These ranks are numeric: the lower the number, the rarer or more threatened the element. The ranking system is used nationally and internationally by The Nature Conservancy to set protection priorities. For the majority of Hawaiian plants, animals and natural communities, an element that is rare in the state is also rare globally. The rank definitions are presented below:

Rank 1 elements are critically imperilled globally because of extreme rarity OR factors that make them especially vulnerable to extinction range-wide. The criteria for this rank are: 1-5 occurrences, or fewer than 1,000 individuals (for species).

Rank 2 elements are considered imperilled globally because of rarity OR factors that make them very vulnerable to extinction range-wide. The criteria for this rank are: 6-20 occurrences, or 1,000-3,000 individuals (for species).

All Priority 1 and 2 elements are called "rare" in this overview.

Rank 3 elements may be rare and locally distributed OR found only in a restricted range. Even the most common endemic Hawaiian species and communities are given Priority 3 rank, since they are restricted to the state. However, they are not considered rare in this overview. The criteria for this rank are: 21-100 occurrences, or 3,000-10,000 individuals.

Rank 4 elements are apparently secure globally although they may be rare locally. The criteria for this rank are: >100 occurrences, or >10,000 individuals.

Rank 5 elements are demonstrably secure globally although they may be rare locally. These are often indigenous, widespread species and natural communities.



## Appendix 3

### Protection Status of Hawaiian Natural Communities

### Appendix 3: Protection Status of Hawaiian Natural Communities

The following table summarizes the known presence of the 180 recognized native Hawaiian natural communities in areas designated for their protection. It is derived from information available in the Hawaii Heritage Program's Natural Community Database as of November 1987. It is based on the information extracted from published literature, unpublished reports and personal observations of field biologists. All available information has not yet been incorporated into the Heritage database. Hence, both the presence and absence of natural communities may require confirmation, and these data should be considered provisional. The ranks provided for each community are defined in Appendix 2. In the overview, all rank 1 and 2 communities are considered rare.

#### Key to abbreviations and footnotes:

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##### Land management:

NAR = Natural Area Reserves System  
StS = State Sanctuary/Wilderness Preserve  
StO = Other State Land (county parks not included)  
NPS = National Parks  
FWS = Fish and Wildlife Service Refuges  
USA = Other Federal Land  
TNC = Preserves of The Nature Conservancy of Hawaii  
Pro = Other Private Land (includes county parks)

<sup>1</sup> Poorly understood natural community

+ = At least one known example

- = No known example

? = Uncertain, or need confirmation

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
AQUATIC ECOSYSTEMS

Community Name		Rank	Included in:							
			NAR	StS	StO	NPS	FWS	USA	TNC	PrO
<b>COASTAL ZONE:</b>										
1.	Uncharacterized Anchialine Pools <sup>1</sup>	?	-	-	+	+	-	-	-	+
2.	High Salinity Lava Tube Anchialine Pool	1	-	-	+	-	-	-	-	-
3.	High Salinity Lava Anchialine Pool	2	+	-	+	+	-	-	-	+
4.	High Salinity Limestone Anchialine Pool	1	-	+	-	-	-	-	-	-
5.	Low Salinity Lava Anchialine Pool	3	+	-	+	+	-	-	-	+
6.	Low Salinity Lava Tube Anchialine Pool	1	-	-	+	-	-	-	-	+
7.	Low Salinity Limestone Anchialine Pool	1	-	-	-	-	-	-	-	+
<b>LOWLAND ZONE:</b>										
8.	Hawaiian Estuary	2	-	+	+	-	+	-	-	+
9.	Lowland Freshwater Lake	3	-	-	+	-	-	-	-	+
10.	Lowland Brackish Lake	1?	-	+	-	-	-	-	-	-
11.	Lowland Hypersaline Lake	1	-	-	-	-	+	-	-	+
<b>MONTANE ZONE:</b>										
12.	Hawaiian Montane Lake <sup>1</sup>	3	+	-	+	+	+	-	-	+
<b>ALPINE ZONE:</b>										
13.	Hawaiian Alpine Lake	1	+	-	-	-	-	-	-	-
<b>MULTI-ZONE:</b>										
14.	Continuous Perennial Streams	1	+	-	+	+	-	-	+	+
15.	Intermittent Streams	4	+	-	+	+	+	+	+	+
16.	Springs & Seeps <sup>1</sup>	4	+	+	+	+	+	+	+	+

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
SUBTERRANEAN ECOSYSTEMS

Community Name	Rank	Included in:							
		NAR	StS	StO	NPS	FWS	USA	TNC	Pro
COASTAL ZONE:									
17. Uncharacterized Coastal Lava Tube <sup>1</sup>	1	+	-	+	+	-	-	-	+?
18. <u>Meioneta gagnei/Hawaiioscia parvituberculata</u> Cave <sup>1</sup>	1	+	-	-	-	-	-	-	-
LOWLAND ZONE:									
19. Blind Hunting Spider Cave <sup>1</sup>	1	-	-	-	-	-	-	-	+
20. Lowland Dry Limestone Cave <sup>1</sup>	1	-	-	+	-	-	+	-	+
21. Lowland `Ohi`a (or other) Lava Tube <sup>1</sup>	1	-	-	+	+	-	-	+	+
22. Blind Cricket Lowland Cave <sup>1</sup>	1	-	-	-	-	-	-	+	+?
MONTANE ZONE:									
23. Blind Cricket Montane Cave <sup>1</sup>	1	-	-	-	-	-	-	-	+
24. Montane Koa/`Ohi`a Lava Tube <sup>1</sup>	1	-	-	-	-	-	-	-	+
25. Montane `Ohi`a Wet Forest Lava Tube <sup>1</sup>	2	-	-	+	+	-	-	+	+
26. Montane Wet Piping Cave <sup>1</sup>	1	-	-	-	-	-	-	-	+
SUBALPINE ZONE:									
27. Subalpine `Ohi`a Shrubland Lava Tube <sup>1</sup>	1	-	-	-	+?	-	-	+	-
ALPINE ZONE:									
28. Alpine Lava Tube <sup>1</sup>	1	-	-	+	+	-	-	-	+

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Included in:

Community Name	Rank	NAR	StS	StO	NPS	FWS	USA	TNC	PrO
COASTAL ZONE:									
COASTAL DRY HERBLAND									
29. Nama Coastal Dry Herbland	1	-	-	+	-	+	-	-	+
30. `Akulikuli Coastal Dry Herbland	3	+	-	+	+	+	-	-	+
COASTAL DRY GRASSLAND									
31. Kawelu Coastal Dry Grassland	1	-	-	-	-	+	-	-	-
32. Kawelu Coastal Dry Cliffs	2	+	+	+	-	-	-	+	+
33. <u>Fimbristylis</u> Coastal Dry Grassland	3	-	+	+	+	+	-	+	+
34. <u>Lepturus repens</u> Coastal Dry Grassland	1?	-	-	-	-	+	-	-	-
35. `Aki`aki Coastal Dry Grassland	4	-	+	+	+	+	+	+	+
COASTAL DRY MIXED SHRUB & GRASSLAND									
36. `Ilima/Ko`olua`ula/Pili Coastal Dry Mixed Shrub & Grassland	1	-	-	-	-	-	+	-	+
37. `Ilima/Kakonakona Coastal Dry Mixed Shrub & Grassland	2?	+	+	+	-	+	+	-	+
38. `Ilima/Pili Coastal Dry Mixed Shrub & Grassland <sup>1</sup>	2?	+	-	-	-	-	-	-	-
COASTAL DRY SHRUBLAND									
39. `Aweoweo/ <u>Solanum nelsoni</u> / <u>`Ilima</u> Coastal Dry Shrubland	1	-	-	-	-	+	-	-	-
40. `Aweoweo Mixed Coastal Dry Shrubland	1	-	-	-	-	+	+	-	+
41. Ma`o Coastal Dry Shrubland	1	-	-	-	-	-	+	-	+
42. Hinahina Mixed Coastal Dry Shrubland <sup>1</sup>	1	+	-	-	-	-	-	+	+
43. `Anaunau Coastal Dry Shrubland	1?	-	-	-	-	-	+	-	-
44. Naio Coastal Dry Shrubland	1	+	-	+	-	-	+	-	+
45. `Iliahi Coastal Dry Shrubland	1?	-	-	+	-	-	-	-	+
46. Naupaka ( <u>Scaevola coriacea</u> ) Mixed Coastal Dry Shrubland	1	-	+	-	-	-	-	-	+
47. Naupaka ( <u>Scaevola sericea</u> ) Coastal Dry Shrubland	4	+	+	+	+	+	+	+	+
48. Naupaka ( <u>Scaevola sericea</u> ) Mixed Coastal Dry Shrubland	1	+	+	+	-	-	-	+	+

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

		Included in:							
Community Name	Rank	NAR	StS	StO	NPS	FWS	USA	TNC	Pro
COASTAL DRY SHRUBLAND (continued)									
49. Naupaka ( <u>Scaevola sericea</u> )/ `Ohai Coastal Dry Shrubland	1	-	-	+	+	-	-	-	+
50. Ma`oli`oli Coastal Dry Shrubland	1?	-	-	+	-	-	-	-	-
51. `Ilima/`Akoko ( <u>Chamaesyce celastroides</u> ) Coastal Dry Shrubland	1	+	-	+	-	-	-	-	+
52. `Ilima /Nehe ( <u>Lipochaeta rockii</u> ) Coastal Dry Shrubland <sup>1</sup>	1?	-	-	-	-	-	+	-	-
53. `Ilima/Puapilo/Nehe Coastal Dry Shrubland	1?	-	-	+	-	-	-	-	+
54. `Ilima/Pa`u o Hi`iaka Coastal Dry Shrubland <sup>1</sup>	3	+	+	+	-	-	+	+	+
55. `Ilima/ <u>Tetramolopium rockii</u> Coastal Dry Shrubland	1	-	-	+	-	-	+	+	+
56. `Ilima/Nehe ( <u>Lipochaeta integrifolia</u> ) Coastal Dry Shrubland	3	+	+	+	-	-	-	+	+
57. Nohu Coastal Dry Shrubland	2	-	-	-	-	+	-	-	-
COASTAL MESIC SHRUBLAND									
58. Nehe ( <u>Lipochaeta succulenta</u> ) Coastal Mesic Shrubland <sup>1</sup>	2	-	-	+	+	-	-	+	+
COASTAL MESIC FOREST									
59. Hala Coastal Mesic Forest	3	+	-	+	+	+	-	+	+
60. Loulu ( <u>Pritchardia remota</u> ) Coastal Mesic Forest	1	-	-	-	-	+	-	-	-
61. Loulu ( <u>Pritchardia gaudichaudii</u> ) Coastal Mesic Forest	1	-	+	-	+	-	-	-	-
COASTAL MESIC UNVEGETATED									
62. <u>Cacenomobius</u> Cricket Boulder Coast <sup>1</sup>	3?	-	+	+	-	-	-	-	+
COASTAL WET GRASSLAND									
63. `Aka`akai/Makaloa Coastal Wet Grassland	3	-	+	+	+	+	-	-	+

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Community Name	Rank	Included in:								
		NAR	StS	StO	NPS	FWS	USA	TNC	Pro	
LOWLAND ZONE:										
LOWLAND DRY HERBLAND										
64. `Ihi`ihi Vernal Pool	1	-	-	-	-	-	+	+	+?	
LOWLAND DRY GRASSLAND										
65. Pili Lowland Dry Grassland	2?	+?	+	+	+	-	+	-	+	
LOWLAND DRY MIXED SHRUB & GRASSLAND										
66. Alahe`e/`Akoko/Pili Lowland Dry Cliffs	2?	+	-	+?	-	-	-	-	+?	
67. `A`ali`i/Pili/Kawelu Lowland Mixed Shrub and Grassland	1	+	-	+	-	-	-	-	+	
LOWLAND DRY SHRUBLAND										
68. Ko`oko`olau ( <u>Bidens menziesii</u> ) Lowland Dry Shrubland <sup>1</sup>	2?	+	-	-	-	-	-	-	+	
69. Ko`oko`olau ( <u>Bidens</u> spp) Lowland Dry Shrubland <sup>1</sup>	3?	-	-	+	-	-	-	-	+	
70. Ko`oko`olau/`Aweoweo Lowland Dry Shrubland	1	-	-	-	-	-	-	-	+	
71. `A`ali`i/Nehe ( <u>Lipochaeta lavarum</u> ) Lowland Dry Shrubland	1?	-	-	-	-	-	-	-	+	
72. `A`ali`i Mixed Lowland Dry Shrubland <sup>1</sup>	2?	+	-	+	-	-	-	-	+	
73. `A`ali`i/Na`ena`e ( <u>Dubautia linearis</u> ) Lowland Dry Shrubland	1?	-	-	+	-	-	-	-	+	
74. `A`ali`i/`Akoko ( <u>Chamaesyce celastroides?</u> ) Lowland Dry Shrubland <sup>1</sup>	1	+?	-	+	-	-	-	-	-	
75. `A`ali`i Lowland Dry Shrubland	3	-	-	+	+	-	+	-	+	
76. `Ohai Lowland Dry Shrubland	1	-	-	+	+	-	-	-	+	
77. `Akia/`A`ali`i/`Ulei Lowland Dry Shrubland	3?	+	-	+	+	-	+	-	+	
78. `Akia/`Akoko ( <u>Chamaesyce celastroides</u> ) Lowland Dry Cliffs	2	+	-	+	+	-	-	-	+	

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Community Name	Rank	Included in:							
		NAR	StS	StO	NPS	FWS	USA	TNC	Pro
LOWLAND DRY FOREST									
79. Koa Lowland Dry Forest	1	-	-	+	-	-	-	-	+
80. Lama Lowland Dry Forest	3	-	-	+	+	-	+	-	+
81. Lama/Kauila Lowland Dry Forest	1	-	-	+	-	-	-	-	+
82. Wiliwili Lowland Dry Forest	2	+	-	+	-	-	+	-	+
83. Wiliwili/'Ohe makai Lowland Dry Forest	1?	+	-	+	+	-	+	-	+
84. 'Ohi'a Mixed Lowland Dry Forest	2	-	-	+	+	-	-	+	+
85. Olopua/Lama Lowland Dry Forest	1?	-	-	-	-	-	-	-	+
LOWLAND DRY FOREST (continued)									
86. Lonomea Lowland Dry Forest	1?	+	-	+	-	-	+	-	+
LOWLAND MESIC GRASSLAND									
87. Kawelu Lowland Mesic Grassland	3	+	-	+	+	-	-	+	+
LOWLAND MESIC SHRUBLAND									
88. 'A'ali'i/Pukiaawe Lowland Mesic Shrubland	2	+	-	+	-	-	+	-	+
89. Nehe/Ma'oli'oli/Kulu'i Mixed Shrub Mesic Cliff	2	+	-	+	-	-	-	-	+
90. 'Ohi'a Mixed Lowland Mesic Shrubland	2	+	-	+	-	-	+	-	+
91. 'Ulei Lowland Mesic Shrubland	3	-	-	+	-	-	+	-	+
92. 'Iliau ( <u>Wilkesia gymnoxiphium</u> )/'A'ali'i Lowland Mesic Shrubland	1	-	-	+	-	-	-	-	-
93. 'Iliau ( <u>Wilkesia hobbii</u> ) Mixed Shrub Lowland Mesic Cliffs	1	-	-	+	-	-	-	-	-
LOWLAND MESIC FOREST									
94. Koa Lowland Mesic Forest	1	-	-	-	-	-	-	-	+
95. Koa/'Ohi'a Mixed Lowland Mesic Forest	2	+	-	+	-	-	+	-	+
96. Koa/'Ohi'a Lowland Mesic Forest	3	-	-	+	-	-	+	-	+
97. Lama/'Ohi'a Mixed Lowland Mesic Forest	2?	+	-	+	+	-	+	+	+
98. Lama/Olopua Lowland Mesic Forest	1	+	-	+	-	-	-	-	+



PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

		Included in:							
Community Name	Rank	NAR	StS	StO	NPS	FWS	USA	TNC	Pro
LOWLAND MESIC FOREST (continued)									
99. Kauai Diverse Lowland Mesic Forest	1	+	-	+	-	-	-	-	-
100. Oahu Diverse Lowland Mesic Forest	1	+	-	+	-	-	-	-	+
101. Lanai Diverse Lowland Mesic Forest	1	-	-	-	-	-	-	-	+
102. `Ohi`a/Uluhe Lowland Mesic Forest	3	+	-	+	-	-	+	-	+
103. `Ohi`a/Kopiko Mixed Lowland Mesic Forest	2	+	-	+	+	-	-	-	+
104. `Ohi`a Mixed Lowland Mesic Forest	1	+	-	+	-	-	-	-	+
105. `Ohi`a/Mixed Shrub Lowland Mesic Forest	1	-	-	-	-	-	-	-	+
106. Olopua/Halapepe Mixed Lowland Mesic Forest	2	-	-	+	-	-	-	-	+
107. Olopua Mixed Lowland Mesic Forest	1	+	-	+	-	-	-	-	-
108. Papala kepau/Papala Lowland Riparian Forest	3	+	-	+	-	-	+	-	+
109. Loulu ( <u>Pritchardia kaalae</u> ) Lowland Mesic Forest	1?	-	-	+	-	-	-	-	-
LOWLAND WET GRASSLAND									
110. `Uki ( <u>Cladium leptostachyum</u> ) Lowland Wet Grassland	1?	-	+	+	-	-	-	-	-
111. Kawelu Lowland Wet Grassland	3?	-	-	+	-	-	-	-	+
LOWLAND WET MIXED									
112. `Uki ( <u>Machaerina angustifolia</u> )/Mixed Shrub Sedge & Shrubland <sup>1</sup>	3?	+	-	+	+	-	-	-	+
113. `Ohi`a/Kuolohia/Uluhe Lowland Mixed Semi-Bog	1	-	-	-	-	-	-	-	+
LOWLAND WET SHRUBLAND									
114. `Ohi`a/Uluhe Lowland Wet Shrubland	2	-	-	+	-	-	-	-	+
115. Mamaki Lowland Riparian Shrubland	3	+	-	+	+	-	-	+	+

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Community Name	Rank	Included in:							
		NAR	StS	StO	NPS	FWS	USA	TNC	Pro
LOWLAND WET FOREST									
116. Koa/`Ohi`a Lowland Wet Forest	2	+	-	+	+	-	-	-	+
117. `Ohi`a Mixed Lowland Wet Forest	2?	-	-	+	-	-	+	-	+
118. `Ohi`a/Mixed Shrub Lowland Wet Forest	1	-	-	+	-	-	-	-	+
119. `Ohi`a/`Olapa(Lapalapa) Lowland Wet Forest	3	+	-	+	+	-	+	+	+
120. `Ohi`a/Hapu`u Lowland Wet Forest	1	+	-	+	+	-	-	-	+
121. `Ohi`a/Uluhe Lowland Wet Forest	3	+	-	+	+	-	+	-	+
122. `Ohi`a/`Ie`ie Lowland Wet Forest	3?	+	-	+	+	-	-	-	+
123. `Ohi`a/Lama Lowland Wet Forest	1	-	-	+	+	-	-	-	+
124. `Ohi`a/Hala Lowland Wet Forest	1	-	-	+	-	-	-	-	+
125. Loulu ( <u>Pritchardia hardyi</u> ) Lowland Wet Forest	2?	-	-	+	-	-	-	-	-
126. Loulu ( <u>Pritchardia martii</u> ) Lowland Wet Forest	2?	-	-	+	-	-	-	-	+
MONTANE ZONE:									
MONTANE DRY GRASSLAND									
127. <u>Deschampsia australis</u> Montane Dry Grassland <sup>1</sup>	1?	-	-	-	+	-	-	-	-
MONTANE DRY SHRUBLAND									
128. `Ohi`a/`A`ali`i Montane Dry Shrubland	2	-	-	+	+	-	+	-	+
MONTANE DRY FOREST									
129. Koa/Mamane Montane Dry Forest	1	-	-	+	+	-	-	-	+
130. `Akoko ( <u>Chamaesyce olowaluana</u> ) Montane Dry Forest	1	-	-	+	-	-	-	-	-
131. `Akoko ( <u>Chamaesyce celastroides?</u> ) Montane Dry Forest	1?	-	-	+	+	-	-	-	+
132. `Ohi`a Mixed Montane Dry Forest	2?	-	-	+	+	-	-	-	+

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Included in:

Community Name	Rank	NAR	StS	StO	NPS	FWS	USA	TNC	Pro
MONTANE MESIC FOREST									
133. Koa/`Ohi`a Montane Mesic Forest	1?	+	-	+	-	+	-	+	+
134. Koa/`Ohi`a/`A`ali`i Montane Mesic Forest	1?	-	-	+	+	-	-	-	+
135. Koa/`Ohi`a/Manele Montane Mesic Forest	1	-	-	+	+	-	-	-	-
136. Koa/`Iliahi Montane Mesic Forest	1	-	-	+	-	-	-	-	+
137. Maui Diverse Montane Mesic Forest	1	-	-	+	-	-	-	-	+
138. `Ohi`a Montane Mesic Forest	2?	+	-	+	+	-	-	-	+
139. Olopuia Mixed Montane Mesic Forest	1	-	-	+	-	-	-	-	+
MONTANE WET HERBLAND									
140. <u>Racomitrium</u> Moss Montane Bog	1	-	-	+	-	-	-	-	-
MONTANE WET GRASSLAND									
141. `Uki ( <u>Carex alligata</u> ) Montane Wet Sedgeland	2	+	-	+	+	-	-	-	-
142. `Uki ( <u>Carex svenonis</u> ) Montane Wet Sedgeland	1?	-	-	+	+	-	-	-	-
143. `Uki ( <u>Carex</u> )/ <u>Kuolohia</u> / <u>Oreobolus furcatus</u> Montane Wet Sedgeland	1	+	+	+	-	-	-	-	+
MONTANE WET MIXED									
144. `Ohi`a/`Ohelo/`Uki ( <u>Machaerina angustifolia</u> ) Mixed Montane Bog	1	-	-	+	-	-	-	-	-
145. `Ohi`a/ <u>Kuolohia</u> / <u>Oreobolus furcatus</u> Mixed Montane Bog	1	+	+	+	-	-	-	+	+
146. `Ohi`a/Na`ena`e ( <u>Dubautia waialealae</u> )/ <u>Kuolohia</u> Mixed Montane Bog	1	-	+	+	-	-	-	-	+
147. `Ohi`a/ <u>Sphagnum</u> sp. Mixed Montane Bog	1?	+	-	+	-	-	-	-	+
148. `Ohi`a/ <u>Deschampsia australis</u> / <u>Oreobolus furcatus</u> Mixed Montane Semi-Bog	1	-	+	+	-	-	-	-	-

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Community Name	Rank	Included in:							
		NAR	StS	StO	NPS	FWS	USA	TNC	Pro
MONTANE WET SHRUBLAND									
149. `Ohi`a Montane Wet Shrubland	2	+	-	+	-	-	-	+	-
150. Mixed Fern/`Ape`ape Montane Wet Cliffs	2?	+	-	+	+	-	-	-	+
151. Mixed Fern/Shrub Montane Wet Cliffs	3	+	-	+	+	-	-	+	+
152. `Akala Montane Wet Shrubland	3	+	-	+	+	-	-	+	+
MONTANE WET FOREST									
153. Koa/`Ohi`a Montane Wet Forest	1?	+	-	+	-	+	-	+	+
154. `Ohi`a Mixed Shrub Montane Wet Forest	3	+	+	+	-	+	-	+	+
155. `Ohi`a/`Olapa (Lapalapa) Montane Wet Forest	2	+	+	+	+	-	-	+	+
156. `Ohi`a/ <u>Sphagnum</u> sp. Montane Wet Forest	2	+	-	+	+	-	-	-	+
157. `Ohi`a/Hapu`u Montane Wet Forest	3	+	-	+	+	+	-	+	+
158. `Ohi`a/Uluhe Montane Wet Forest	3	+	+	+	+	+	-	+	+
159. Hapu`u Montane Wet Forest ( `Ohi`a successional?)	1?	-	-	+	+	-	-	-	+
SUBALPINE ZONE:									
SUBALPINE DRY GRASSLAND									
160. Kawelu/Kakonakona ( <u>Panicum tenuifolium</u> ) Subalpine Dry Grassland	1?	-	-	+	-	-	+	-	-
SUBALPINE DRY SHRUBLAND									
161. `Aweoweo Subalpine Dry Shrubland	1?	-	-	+	-	-	+	-	-
162. `A`ali`i/Na`ena`e/Ko`oko`olau/Naio Subalpine Dry Shrubland	1	-	-	+	-	-	+	-	-
163. `A`ali`i/`Ohelo/Pukiawe Subalpine Dry Shrubland	2	-	-	+	+	-	-	-	+
164. Pukiawe/`Ohelo Subalpine Dry Shrubland	2	-	-	+	+	-	-	-	+

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Community Name	Rank	Included in:							
		NAR	StS	StO	NPS	FWS	USA	TNC	Pro
SUBALPINE DRY FOREST									
165. `Ohi`a Subalpine Dry Forest	2	-	-	+	+	-	-	-	+
166. Mamane Subalpine Dry Forest	2	-	-	+	+	-	+	-	+
167. Mamane/Naio Subalpine Dry Forest	1	-	-	+	+	-	+	-	+
SUBALPINE MESIC GRASSLAND									
168. <u>Deschampsia australis</u> Subalpine Mesic Grassland	1?	+	-	+	+	-	+	-	+
SUBALPINE MESIC SHRUBLAND									
169. `Ama`u/`Ohelo Subalpine Mesic Shrubland	1	-	-	+	+	-	-	+	-
SUBALPINE WET GRASSLAND									
170. `Uki/ <u>Deschampsia australis</u> / <u>Oreobolus furcatus</u> Mixed Grass & Sedge Subalpine Bog	1	-	-	-	+	-	-	-	-
ALPINE ZONE:									
ALPINE DESERT									
173. Hawaiian Alpine Aeolian Desert	1	+	-	+	+	-	-	-	-
ALPINE DRY HERBLAND									
172. Lichen Alpine Desert	2	+	-	+	+	-	+	-	-
173. <u>Racomitrium lanuginosum</u> Moss Alpine Desert	1	+	-	+	+	-	+	-	+
ALPINE DRY SHRUBLAND									
174. `Ahinahina/Kupaoa ( <u>Dubautia menziesii</u> ) Alpine Dry Shrubland	1	-	-	-	+	-	-	-	-

PROTECTION STATUS OF HAWAIIAN NATURAL COMMUNITIES  
NOVEMBER 1987  
TERRESTRIAL ECOSYSTEMS

Community Name	Rank	Included in:							
		NAR	StS	StO	NPS	FWS	USA	TNC	Pro
MULTI-ZONAL COMMUNITIES:									
175. Neogeoaeolian Desert on Lava Flows	2?	+	-	+	+	-	-	-	+
176. 'Ohi'a Pioneer on Lava Flows	3	+	-	+	+	-	-	-	+
177. <u>Stereocaulon vulcani</u> Lichen on Lava Flows <sup>1</sup>	3	+	-	+	+	-	+	-	+
178. Uluhe Successional Shrubland	4	+	+	+	+	+	+	+	+
179. 'Ohi'a Dieback Communities <sup>1</sup>	3	+	-	+	+	+	-	-	+
180. Fumarole Communities	1	-	-	+	+	-	-	-	-

## Appendix 4

### **Hawaii's Natural Area Reserves**

#### Appendix 4. Hawaii's Natural Area Reserves

Hawaii's 18 natural area reserves cover a diversity of habitats on several islands. The following summarize the most prominent features of the reserves, including island, size, year of establishment, elevation range, a brief description of the land and its outstanding features, a checklist of the natural communities currently known for each reserve, and the leading threats to the reserve. Although rare species are known for a few reserves, field surveys are needed to compile complete species lists. Where known, the presence of rare species is mentioned in the descriptions.

These brief summaries are meant to familiarize readers to Hawaii's reserves, and to allow for broad comparisons between them for planning purposes. Future inventories of Hawaii's NARS will provide species lists; confirm and map natural communities, identify key threats and delineate management units.



## HONO O NA PALI

Island: Kauai  
Size: 3,150 acres  
Year established: 1983  
Elevation range: sea level-4200 ft

### Description:

Streams and forested valleys on the Na Pali cliffs include rare coastal plants and nine native communities. Some of the state's most intact stream systems with a complement of native stream animals are included.

Natural communities: (ordered by rank)  
9 total, 5 rare\*

RANK	COMMUNITY
1*	Continuous Perennial Streams
2*	Nehe/Ma'oli'oli/Kulu'i Mixed Shrub Ledge
2*	Lama/'Ohi'a Mixed Lowland Mesic Forest
2*	Kawelu Coastal Dry Cliffs
2*	'Akia/'Akoko Lowland Dry Cliffs
3	'Ohi'a/Uluhe Lowland Wet Forest
3	Hala Coastal Mesic Forest
3	Papala kepau/Papala Lowland Wet Forest
4	Intermittent Streams

Threats: Feral goats; Louisiana crayfish; weeds, especially blackberry, guava, Christmas berry, grasses; marijuana cultivation.

## KUIA

Island: Kauai  
Size: 1,636 acres  
Year established: 1981  
Elevation range: 2200-3900 ft

### Description:

Five types of mesic forest communities in the valleys of northeastern Kokee contain some of the rarest endemic plants, including a rare red-flowered Hawaii tree cotton.

Natural communities: (ordered by rank)  
5 total, 4 rare\*

RANK	COMMUNITY
1*	Kauai Diverse Lowland Mesic Forest
1*	Koa/`Ohi`a Montane Mesic Forest
2*	Koa/`Ohi`a Mixed Lowland Mesic Forest
2*	`A`ali`i/Pukiawe Lowland Mesic Shrubland
3	Koa/`Ohi`a Lowland Mesic Forest

Threats: Feral goats, pigs and deer; marijuana cultivation; weeds, especially blackberry, banana poka, lantana, guava, Christmas berry, grasses; dry season fires.

## KAENA POINT

Island: Oahu  
Size: 12 acres  
Year established: 1983  
Elevation range: sea level-20 ft

### Description:

This reserve includes three coastal native communities on the most western point of Oahu.

Natural communities: (ordered by rank)  
3 total, 1 rare\*

RANK	COMMUNITY
1*	Naupaka Mixed Coastal Dry Shrubland
3	`Ilima/Pa`u o Hi`iaka Coastal Dry Shrubland
4	`Aki`aki Coastal Dry Grassland

Threats: Recreational vehicles, litter, weeds.

## MOUNT KAALA

Island: Oahu  
Size: 1,100 acres  
Year established: 1981  
Elevation range: 1200-4000 ft

### Description:

Eight natural communities that include many rare plants are found on the wet, flat summit and forested ridges of Mt. Kaala. This is the only montane habitat on Oahu.

Natural communities: (ordered by rank)  
8 total, 5 rare\*

RANK	COMMUNITY
2*	Koa/'Ohi'a Mixed Lowland Mesic Forest
2*	Lama/'Ohi'a Lowland Mesic Forest
2*	'Ohi'a/'Olapa Montane Wet Forest
2*	'Ohi'a Mixed Lowland Mesic Shrubland
2*	Mixed Fern/'Ape'ape Montane Wet Cliffs
3	'Ohi'a/'Olapa Lowland Wet Forest
3	'Ohi'a/Uluhe Lowland Wet Forest
3	Mixed Fern/Shrub Montane Wet Cliffs

Threats: Weeds, especially blackberry, Christmas berry, guava and grasses.

## PAHOLE

Island: Oahu  
Size: 658 acres  
Year established: 1981  
Elevation range: 1100-2600 ft

### Description:

Five rare dry and mesic forests occur in Pahole Valley, in the Northern Waianae Mountains, famous for its botanical richness.

Natural communities: (ordered by rank)  
5 total, all rare\*:

RANK	COMMUNITY
1*	Oahu Diverse Lowland Mesic Forest
1*	Lonomea Lowland Dry Forest
1*	Wiliwili/'Ohe makai Lowland Dry Forest
2*	Koa/'Ohi'a Mixed Lowland Mesic Forest
2*	Wiliwili Lowland Dry forest

Threats: Feral pigs, rats, weeds, fires from Makua Valley.

## OLOKUI

Island: Molokai  
Size: 1,620 acres  
Year established: 1985  
Elevation range: near sea level-4602 ft

### Description:

An isolated plateau set between two of Molokai's largest and most undisturbed streams, Olokui is one of two rainforest areas in the state that are free of feral mammals. It is exceptionally intact as a result, providing examples of none native communities and essential forest bird habitat.

Natural communities: (ordered by rank)  
9 total, 3 rare\*

RANK	COMMUNITY
2*	`Ohi`a Montane Wet Shrubland
2*	Kawelu Coastal Dry Cliffs
2*	`Ohi`a/`Olapa Montane Wet Forest
3	Kawelu Lowland Mesic Grassland
3	`Ohi`a/`Olapa Lowland Wet Forest
3	`Ohi`a/Uluhe Lowland Wet Forest
3	`Ohi`a Mixed Shrub Montane Wet Forest
3	`Ohi`a/Hapu`u Montane Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest

Threats: Weeds, feral goats and pigs encroaching from lower slopes.

## PUU ALII

Island: Molokai  
Size: 1,330  
Year established: 1985  
Elevation range: 2500-4222 ft

### Description:

A representative portion of the Molokai summit, including five types of `ohi`a forest, Puu Alii lies between Pelekunu and Waikolu Valleys. Its wet plateau is good forest bird habitat and an important part of Molokai's watershed.

Natural communities: (ordered by rank)  
5 total, 1 rare\*

RANK	COMMUNITY
2*	`Ohi`a/`Olapa Montane Wet Forest
3	`Ohi`a/`Olapa Lowland Wet Forest
3	`Ohi`a/Uluhe Lowland Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest
3	`Ohi`a Mixed Shrub Montane Wet Forest

Threats: Feral pigs, goats, weeds.

## AHIHI-KINAU

Island: Maui  
Size: 1,238 acres on land, 807 acres marine  
Year established: 1973  
Elevation range: below sea level-500 ft

### Description:

Set on the last historic lava flow on Maui, Ahihi-Kinau contains five natural communities, including anchialine pools with a high diversity of rare Hawaiian shrimps, and a unique coastal lava tube community that provides habitat for native Hawaiian cave animals. The marine portion is not characterized here.

Natural communities: (ordered by rank)  
5 total, 3 rare\*

RANK	COMMUNITY
1*	<u>Meioneta gagnei</u> / <u>Hawaiioscia</u> sp. Coastal Lava Tube
1*	Uncharacterized Coastal Lava Tube
2*	High Salinity Lava Anchialine Pool
3	Low Salinity Lava Anchialine Pool
3	Akulikuli Coastal Dry Herbland

Threats: Weeds, potential introduction of non-native fish and invertebrates.



## HANAWI

Island: Maui  
Size: 7,500 acres  
Year established: 1986  
Elevation range: 2000-7500 ft

### Description:

The reserve extends into subalpine zones of Haleakala, and includes 10 native communities, including grasslands, streams, shrublands and forests. The `ohi`a forests are valuable watershed, containing rare plants and providing essential habitat for rare Hawaiian birds.

Natural communities: (ordered by rank)  
10 total, 5 rare\*

RANK	COMMUNITY
1*	<u>Deschampsia australis</u> Subalpine Mesic Grassland
1*	Continuous Perennial Stream
2*	`Ohi`a/`Olapa Lowland Wet Forest
2*	`Ohi`a/`Olapa Montane Wet Forest
2*	`Uki ( <u>Carex alligata</u> ) Montane Wet Sedgeland
3	Intermittent Streams
3	`Ohi`a/Uluhe Lowland Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest
3	`Ohi`a Mixed Shrub Montane Wet Forest
3	`Akala Montane Wet Shrubland

Threats: Feral pigs and goats, weeds.

## WEST MAUI (HONOKOWAI SECTION)

Island: Maui  
Size: 750 acres  
Year established: 1986  
Elevation range: 2500-5788 ft

### Description:

One of four sections that make up the West Maui Reserve, the Honokowai section is on the wet upper northern slopes of the West Maui Mountains, and includes the Puu Kukui summit. Ten native communities are represented, including montane wet forests, bogs, and a montane lake. This section also has great watershed value and includes many rare plants.

Natural communities: (ordered by rank)  
10 total, 4 rare\*

RANK	COMMUNITY
1*	`Ohi`a Mixed Lowland Mesic Forest
2*	`Ohi`a/`Olapa Lowland Wet Forest
2*	`Ohi`a/`Olapa Montane Wet Forest
2*	Mixed Fern/`Ape`ape Montane Wet Cliffs
3	Hawaiian Montane Lake
3	`Uki ( <u>Machaerina angustifolia</u> )/Mixed Shrub Lowland Wet Sedge & Shrubland
3	`Ohi`a/Uluhe Lowland Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest
3	`Ohi`a Mixed Shrub Montane Wet Forest
3	Mixed Fern/Mixed Shrub Montane Wet Cliffs

Threats: Human traffic in bogs, weeds, expanding feral pig population downslope.

## WEST MAUI (KAHAKULOA SECTION)

Island: Maui  
Size: 3,275 acres  
Year established: 1986  
Elevation range: 1000-4480 ft

### Description:

One of four sections of the West Maui Reserve, the Kahakuloa section lies on wet, windward slopes of the West Maui Mountains. Eleven native communities are represented, including the upper reaches of two perennial streams, wet forests and bogs. This section also has great watershed value and includes many rare plants.

Natural communities: (ordered by rank)  
11 total, 5 rare\*

RANK	COMMUNITY
1*	`Uki ( <u>Carex</u> spp.)/ <u>Kuolohia/Oreobolus furcatus</u> Montane Wet Sedgeland
1*	Continuous Perennial Stream
1*	`Ohi`a/ <u>Kuolohia/Oreobolus furcatus</u> Mixed Montane Bog
2*	`Ohi`a/`Olapa Lowland Wet Forest
2*	`Ohi`a/`Olapa Montane Wet Forest
3	Intermittent Streams
3	Hawaiian Montane Lake
3	`Ohi`a/Uluhe Lowland Mesic Forest
3	`Ohi`a/Uluhe Lowland Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest
3	`Ohi`a Mixed Shrub Montane Wet Forest

Threats: Weeds, expanding feral pig population downslope.

## WEST MAUI (LIHAU SECTION)

Island: Maui

Size: 960 acres

Year established: 1986

Elevation range: 1000-4197 ft

### Description:

The driest of the four sections of the West Maui Reserve, Lihau is a steep-sloped plateau running from dry lowlands to a wet summit, with cliffs on all sides. This section includes six rare natural communities and many rare plants.

Natural communities: (ordered by rank)  
6 total, all rare\*

### RANK

### COMMUNITY

- |    |   |
|----|---|
| 1* | `A`ali`i/Pili/Kawelu Lowland Dry Mixed Community              |
| 1* | Koa/`Ohi`a Montane Mesic Forest                               |
| 2* | `Ohi`a Montane Mesic Forest                                   |
| 2* | Ko`oko`olau ( <u>Bidens menziesii</u> ) Lowland Dry Shrubland |
| 2* | `A`ali`i/Pukiawe Lowland Mesic Shrubland                      |
| 2* | `Ohi`a Mixed Lowland Mesic Shrubland                          |

Threats: Fire, weeds, especially grasses.

## WEST MAUI (PANAWEA SECTION)

Island: Maui  
Size: 1,717 acres  
Year established: 1986  
Elevation range: 1550-5220 ft

### Description:

One of four sections of the West Maui Reserve, it includes six mesic and wet communities on the west slopes of the West Maui Mountains. This section also includes rare plants.

Natural communities: (ordered by rank)  
6 total, 3 rare\*

RANK	COMMUNITY
1*	`Ohi`a Mixed Lowland Mesic Forest
2*	`Ohi`a Mixed Lowland Mesic Shrubland
2*	`Ohi`a/`Olapa Montane Wet Forest
3	`Ohi`a/Uluhe Lowland Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest
3	`Ohi`a Mixed Shrub Montane Wet Forest

Threats: Weeds, feral pigs.

## KAHAUALEA

Island: Hawaii  
Size: 16,726 acres  
Year established: 1987  
Elevation range: 1700-3500 ft

### Description:

With representatives of four lowland wet forest communities in Puna, Kahaualea includes one of the few examples of lowland rainforest in the United States. Its young forest communities provide opportunity for research.

Natural communities: (ordered by rank)  
4 total, 1 rare\*

RANK	COMMUNITY
1*	`Ohi`a/Hapu`u Lowland Wet Forest
3	`Ohi`a/Uluhe Lowland Mesic Forest
3	`Ohi`a/`Ie`ie Lowland Wet Forest
3	`Ohi`a Pioneer Community on Lava Flows

Threats: Fires, feral pigs, marijuana cultivation, weeds.

## KIPAHOEHOE

Island: Hawaii  
Size: 5,583 acres  
Year established: 1983  
Elevation range: near sea level-5550 ft

### Description:

A narrow piece of land running down the southwest slopes of Mauna Loa in South Kona, Kipahoehoe includes four types of native mesic and wet forests. The reserve provides native bird habitat and includes rare plants.

Natural communities: (ordered by rank)  
4 total, 2 rare\*

RANK	COMMUNITY
2*	`Ohi`a/Kopiko Mixed Lowland Mesic Forest
2*	Koa/`Ohi`a Lowland Wet Forest
3	`Ohi`a/`Ie`ie Lowland Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest

Threats: Feral pigs, marijuana cultivation, weeds.

## LAUPAHOEHOE

Island: Hawaii  
Size: 7,894 acres  
Year established: 1983  
Elevation range: 1900-4660 ft

### Description:

On the slopes of windward Mauna Kea, five montane wet communities are found, including watershed forests of koa and `ohi`a that provide habitat for forest birds and rare plants. Small montane lakes and wet grasslands occur in the upper section of the reserve.

Natural communities: (ordered by rank)  
5 total, 2 rare\*

RANK	COMMUNITY
1*	Koa/`Ohi`a Montane Mesic Forest
2*	`Uki ( <u>Carex alligata</u> ) Montane Wet Grassland
3	Hawaiian Montane Lake
3	`Ohi`a/Hapu`u Montane Wet Forest
3	`Ohi`a/Uluhe Montane Wet Forest

Threats: Feral pigs; marijuana cultivation, weeds (especially banana poka), logging.



## MANUKA

Island: Hawaii  
Size: 25,550 acres  
Year established: 1983  
Elevation range: near sea level-5524 ft

### Description:

On the broad flank of leeward Mauna Loa in South Kona, Manuka encompasses a wide range of habitats, and includes 11 native communities. These include dry cinderlands, and thick forests of koa and 'ohi'a, where many rare plants and birds are found. The highest concentrations of the Hawaiian hoary bat in the state occur here. Coastal anchialine pools are included as well.

Natural communities: (ordered by rank)  
11 total, 8 rare\*

RANK	COMMUNITY
1*	Olopuia Mixed Lowland Mesic Forest
1*	Lowland 'Ohi'a Lava Tube
1*	Wiliwili/'Ohe makai Lowland Dry Forest
1*	Koa/'Ohi'a Montane Mesic Forest
2*	High Salinity Lava Anchialine Pool
2*	'Ohi'a/Kopiko Mixed Lowland Mesic Forest
2*	Lama/'Ohi'a Mixed Lowland Mesic Forest
2*	Wiliwili Lowland Dry Forest
3	Low Salinity Lava Anchialine Pool
3	'Ohi'a/'Ie'ie Lowland Wet Forest
3	'Ohi'a/Uluhe Montane Wet Forest

Threats: Feral cattle, goats, mouflon and pigs; marijuana cultivation; weeds.

## MAUNA KEA ICE AGE

Island: Hawaii

Size: 3,894 acres

Year established: 1981

Elevation range: ca 10,000-13,441 ft

### Description:

Sparsely vegetated alpine cinder deserts on the south flank of Mauna Kea include four community types, dominated by lichens, mosses or cold-adapted native invertebrates. The only alpine lake in the State is included, as well as archeological and geological features.

Natural communities: (ordered by rank)  
4 total, all rare\*

RANK	COMMUNITY
1*	Hawaiian Glacial Tropical Lake
1*	<u>Racomitrium lanuginosum</u> Alpine Dry Herbland
1*	Hawaiian Alpine Aeolian Desert
2*	Lichen spp. Alpine Dry Herbland

Threats: Vehicular trespass and human disturbance.

## PUU MAKAAALA

Island: Hawaii  
Size: 12,106 acres  
Year established: 1981  
Elevation range: 3000-5518 ft

### Description:

The two types of montane wet forest of this reserve on the northeast flank of Mauna Loa are the principal habitat for some of Hawaii's rarest birds, such as `akiapola`au, Hawaiian creeper, `o`u and Hawaiian hawk. Small examples of a rare sedge bog community are also found in cinder cones near Kulani.

Natural communities: (ordered by rank)  
3 total, 2 rare\*

RANK	COMMUNITY
1*	Koa/`Ohi`a Montane Wet Forest
2*	`Uki ( <u>Carex alligata</u> ) Montane Wet Grassland
3	`Ohi`a/Hapu`u Montane Wet Forest

Threats: Feral pigs, marijuana cultivation, weeds.

PUU O UMI

Island: Hawaii  
Size: 10,142 acres  
Year established: 1987  
Elevation range: sea level-5260 ft

Description:

This reserve contains some of the most intact wet summit lands of the Kohala Mountains, including 13 types of lowland and montane wet communities. These include a unique bog community, representative 'ohi'a forests, streams, and montane wet cliff communities. The reserve extends downslope to include portions of the Kohala seacliffs and incorporates the headwaters of Waimanu Valley.

Natural communities: (ordered by rank)  
13 total, 7 rare\*

RANK	COMMUNITY
1*	'Ohi'a/ <u>Sphagnum</u> sp. Mixed Montane Bog
1*	Continuous Perennial Streams
2*	'Ohi'a Montane Wet Shrubland
2*	'Ohi'a/'Olapa Montane Wet Forest
2*	'Ohi'a/ <u>Sphagnum</u> sp. Montane Wet Forest
2*	Mixed Fern/'Ape'ape Montane Wet Cliffs
2*	'Uki ( <u>Carex alligata</u> ) Montane Wet Grassland
3	Intermittent Streams
3	'Ohi'a/'Olapa Lowland Wet Forest
3	'Ohi'a/Hapu'u Montane wet Forest
3	'Ohi'a/Uluhe Lowland Wet Forest
3	'Ohi'a Mixed Shrub Montane Wet Forest
3	Mixed Fern/Shrub Montane Wet Cliffs

Threats: Feral pigs and cattle, weeds.

## WAIAKEA 1942 LAVA FLOW

Island: Hawaii  
Size: 640 acres  
Year established: 1974  
Elevation range: 2980-3400 ft

### Description:

A recent lava flow being recolonized by young `ohi`a forest dominates this reserve, providing good opportunities for the study of revegetation after lava flows.

Natural communities: (ordered by rank)  
2 total, none rare

RANK	COMMUNITY
3	`Ohi`a/Uluhe Montane Wet Forest
3	`Ohi`a Pioneer Communities on Lava Flows

Threats: No known threats, possibly weeds.

## Appendix 5

### National Parks in Hawaii

## Appendix 5: National Parks in Hawaii

### ISLAND OF MOLOKAI:

Kalaupapa National Historical Park\*  
10,902 acres

### ISLAND OF OAHU:

U.S.S. Arizona Memorial  
12 acres

### ISLAND OF MAUI:

Haleakala National Park\*  
27,350 acres

### ISLAND OF HAWAII:

Hawaii Volcanoes National Park\*  
217,297 acres

Kaloko-Honokohau National Park\*  
322 acres acquired, (1,000 authorized)

Puu Kohola Heiau National Historical Park  
34 acres acquired, (100 authorized)

Puu honua o Honaunau National Historical Park  
181 acres

TOTAL SIZE OF ALL HAWAIIAN NATIONAL PARKS: 256,098 acres  
TOTAL SIZE OF PARKS WITH NATIVE COMMUNITIES: 255,871 acres

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\* Includes native Hawaiian natural communities

## Appendix 6

### U.S. Fish and Wildlife Service Refuges in Hawaii



## Appendix 6: U.S. Fish and Wildlife Service Refuges in Hawaii

### NORTHWEST HAWAIIAN ISLANDS:

Hawaiian Islands National Wildlife Refuge\*  
1,740 acres terrestrial; 252,680 acres marine

### ISLAND OF KAUAI:

Huleia National Wildlife Refuge  
238 acres

Hanalei National Wildlife Refuge  
917 acres

Kilauea Point National Wildlife Refuge\*  
33 acres (31 owned, 2 by easement)

### ISLAND OF OAHU:

James Campbell National Wildlife Refuge  
155 acres in two units:  
    Kii unit (37.5 acres)  
    Punamano unit (117.3 acres)

Pearl Harbor National Wildlife Refuge  
61 acres in two units:  
    Waiawa unit (24.5 acres)  
    Honouliuli unit (36.5 acres)

Punahoolapa Marsh National Wildlife Refuge (proposed)  
120 acres (proposed refuge)

### ISLAND OF MOLOKAI:

Kakahaia National Wildlife Refuge, Molokai  
42 acres

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\* Includes native Hawaiian natural communities

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## Appendix 6: U.S. Fish and Wildlife Service Refuges in Hawaii

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### ISLAND OF MAUI:

Kealia National Wildlife Refuge, Maui (proposed)  
385 acres (proposed refuge)

### ISLAND OF HAWAII:

Hakalau Forest National Wildlife Refuge, Hawaii\*  
13,106 acres (additional acquisitions planned)

Opaepa National Wildlife Refuge, Hawaii (proposed)  
37 acres (proposed refuge)

TOTAL SIZE OF ALL USFWS WILDLIFE REFUGES: 16,834 acres  
TOTAL SIZE OF REFUGES WITH NATIVE COMMUNITIES: 14,879 acres

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\* Includes native Hawaiian natural communities

## Appendix 7

### Hawaii State Sanctuaries and Wilderness Preserves

## Appendix 7: State Sanctuaries and Wilderness Preserves

### OFFSHORE ISLANDS:

Hawaii State Seabird Sanctuary\* (300 acres, several sites:)

Kure Atoll, NW Hawaiian Islands  
Mokuaee Islet, Kilauea, Kauai  
Lehua Island, Waimea, Kauai  
Kaula Island, Waimea, Kauai  
Kihewamoku Island, Kahuku, Oahu  
Mokuauia Island, Laie, Oahu  
Pulemoku, Laie, Oahu  
Kukuihoolua Islet, Laie, Oahu  
Mokualai Islet, Laie, Oahu  
Moku Manu, Mokapu, Oahu  
Mokolea, Kailua, Oahu  
Mokulua Islands, Kailua, Oahu  
Popoia Island, Kailua, Oahu  
Manana Island, Waimanalo, Oahu  
Kaohikaipu Island, Waimanalo, Oahu  
Kanaha Rock, Moakea, Molokai  
Mokuhooniki, Moakea, Molokai  
Huelo rock, Waikolu, Molokai  
Mokapa Island, Waikolu, Molokai  
Okala Island, Waikolu, Molokai  
Mokumanu, Pelekunu, Molokai  
Puupehe, Manele, Lanai  
Poopoo, Huawai Bay, Lanai  
Moku Naio, Kaunolu, Lanai  
Nanahoa Islets, Honopu Bay, Lanai  
Alau Island, Hana, Maui  
Puuku Island, Hana, Maui  
Keopuka Rock, Hana, Maui  
Moku Mana, Keanae, Maui  
Moku Hala, Keanae, Maui  
Papanui o Kane, Makawao, Maui  
Mokeehia Island, Lahaina, Maui  
Hulu Island, Wailuku, Maui  
Molokini, Makena, Maui  
Paoakalani Island, North Kohala, Hawaii  
Mokupuku, North Kohala, Hawaii  
Keaoi, Kau, Hawaii

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\* Includes native Hawaiian natural communities

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## Appendix 7: State Sanctuaries and Wilderness Preserves

(continued from previous page)

### ISLAND OF KAUAI:

Alakai Wilderness Preserve\*, Kokee  
9400 acres

### ISLAND OF OAHU:

Paiko Lagoon Wildlife Sanctuary, Honolulu  
33 acres

Puu Kuua Gardenia Sanctuary, Ewa  
1 acre

### ISLAND OF MOLOKAI:

Kamiloloa `Ohai (Sesbania arborea) Sanctuary\*, Kamalo  
12 acres

### ISLAND OF MAUI:

Kanaha Pond Wildlife Sanctuary, Wailuku  
145 acres

Plant Sanctuaries: 28 acres total

Kaunoanua Hibiscus brackenridgei Sanctuary, Wailuku

Manawainui Plant Sanctuary, Hanaula

Paupau Plant Sanctuary, Lahainaluna

Polipoli Geranium arboreum Sanctuary, Kula

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\* Includes native Hawaiian natural communities

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## Appendix 7: State Sanctuaries and Wilderness Preserves

(continued from previous page)

### ISLAND OF HAWAII:

Kahuku Nene (Hawaiian goose) Sanctuary\*, Kau  
20,000 acres (by informal agreement with private landowner)

Keauhou I Nene (Hawaiian goose) Sanctuary\*, Kau  
8,400 acres (by informal agreement with private landowner)

Keauhou II Nene (Hawaiian goose) Sanctuary\*, North Kona  
12,678 acres (by informal agreement with private landowner)

Kipuka Ainahou Nene (Hawaiian goose) Sanctuary\*, Kau  
38,400 acres

Puuwaawaa `Alala (Hawaiian Crow) Sanctuary\*, Kona  
3,400 acres

Plant sanctuaries: 30 acres total

Puuwaawaa Hibiscadelphus hualalaiensis Sanctuary, Kona

Upper Waiakea Bog Argyroxiphium kauense Sanctuary, Waiakea

Waiakamali Acacia koaia Sanctuary, Kohala

Wailuku Mauna Kea Silversword (Argyroxiphium sandwicense  
sandwicense) Sanctuary\*, Wailuku

TOTAL SIZE OF ALL STATE SANCTUARIES: 92,827 acres  
TOTAL SIZE OF SANCTUARIES WITH NATIVE COMMUNITIES: 92,600 acres

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\* Includes native Hawaiian natural communities

## Appendix 8

### Preserves of The Nature Conservancy of Hawaii

## Appendix 8: Preserves of The Nature Conservancy of Hawaii

### ISLAND OF KAUAI:

Kaluahonu Preserve\*  
213 acres

### ISLAND OF OAHU:

Ihiihilauakea Preserve\*  
30 acres  
(via management agreement with City and County of Honolulu)

### ISLAND OF MOLOKAI:

Kamakou Preserve\*  
2,774 acres

Pelekunu Preserve\*  
5,759 acres

Moomomi Preserve\*  
900 acres (pending)

### ISLAND OF MAUI:

East Maui Lava Tube Preserve\*  
75 acres

Waikamoi Preserve\*  
5,231 acres

TOTAL SIZE OF ALL PRESERVES: 14,982 acres

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\* Includes native Hawaiian natural communities



## Appendix 9

### Common and Scientific Names in Overview

## Appendix 9: Common and Scientific Names in Overview

Common or Hawaiian Name	Scientific Name
`a`ali`i	<u>Dodonaea</u> spp.
`ahinahina	<u>Argyroxiphium</u> spp.
`aka`akai	<u>Bolboschoenus</u> & <u>Schoenoplectus</u> spp.
`akala	<u>Rubus hawaiiensis</u>
`aki`aki	<u>Sporobolus virginicus</u>
`akia	<u>Wikstroemia</u> spp.
`akoko	<u>Euphorbia</u> , <u>Chamaesyce</u> spp.
`akulikuli	<u>Sesuvium portulacastrum</u>
alahe`e	<u>Canthium odoratum</u>
ama`u	<u>Sadleria</u> spp.
anaunau	<u>Lepidium bidentatum</u>
ape`ape	<u>Gunnera</u> spp.
aweoweo	<u>Chenopodium oahuense</u>
Christmas berry	<u>Schinus terebinthifolius</u>
guava	<u>Psidium</u> spp.
hala	<u>Pandanus</u> spp.
halapepe	<u>Pleomele</u> spp.
hapu`u	<u>Cibotium</u> spp.
hinahina	<u>Heliotropium</u> spp.
`ie`ie	<u>Freycinetia arborea</u>
`ihi`ihi	<u>Marsilea villosa</u>
`iliahi (sandalwood)	<u>Santalum</u> spp.
`iliau	<u>Wilkesia</u> spp.
`ilima	<u>Sida</u> spp.
`io (Hawaiian hawk)	<u>Buteo solitarius</u>
kakonakona	<u>Panicum</u> spp.
kauila	<u>Alphitonia ponderosa</u>
kawelu	<u>Eragrostis</u> spp.
ko`oko`olau	<u>Bidens</u> spp.
ko`oloa`ula	<u>Abutilon sandwicense</u>
koa	<u>Acacia koa</u>
kopiko	<u>Psychotria</u> spp.
Koster's curse	<u>Clidemia hirta</u>
kulu`i	<u>Nototrichium</u> spp.
kuolohia	<u>Rhynchospora chinensis</u> <u>spiciformis</u>
kupaoa	<u>Dubautia menziesii</u>
lama	<u>Diospyros sandwicensis</u>
lantana	<u>Lantana camara</u>
lapalapa	<u>Cheirodendron platyphyllum</u>
lonomea	<u>Sapindus oahuensis</u>
loulu	<u>Pritchardia</u> spp.
ma`o	<u>Gossypium tomentosum</u>
ma`oli`oli	<u>Schiedea</u> spp.
makaloa	<u>Cyperus laevigatus</u>
mamaki	<u>Pipturus albidus</u>
mamane	<u>Sophora chrysophylla</u>

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## Appendix 9: Common and Scientific Names in Overview

(continued from previous page)

Common or Hawaiian Name	Scientific Name
na`ena`e	<u>Dubautia spp.</u>
naio	<u>Myoporum sandwicense</u>
naupaka	<u>Scaevola spp.</u>
nehe	<u>Lipochaeta spp.</u>
nene (Hawaiian goose)	<u>Nesochen sandwicensis</u>
nohu	<u>Tribulus cistoides</u>
`ohai	<u>Sesbania tomentosa</u>
`ohe makai	<u>Reynoldsia sandwicensis</u>
`ohi`a	<u>Metrosideros polymorpha</u>
`olapa	<u>Cheirodendron trigynum</u>
olopua	<u>Nestegis sandwicensis</u>
pa`u-o-Hi`iaka	<u>Jacquemontia sandwicensis</u>
papala	<u>Charpentiera spp.</u>
papala kepau	<u>Pisonia spp.</u>
pili	<u>Heteropogon contortus</u>
puapilo	<u>Capparis sandwichiana</u>
pukiawe	<u>Styphelia tameiameia</u>
`uki	<u>Machaerina, Carex, Cladium spp.</u>
`ulei	<u>Osteomeles anthyllidifolia</u>
uluhe	<u>Dicranopteris linearis</u>
wiliwili	<u>Erythrina sandwicensis</u>